

## Mesothele spiders in the Museum für Naturkunde Berlin

Jason A. Dunlop, Corinna Steffensen & Hirotugu Ono

doi: 10.5431/aramit4705

**Abstract.** An annotated catalogue of the rare mesothele spiders (Araneae: Mesothelae: Liphistiidae) held in the Museum für Naturkunde Berlin is presented. The museum hosts non-type specimens of nine species representing all three currently recognised genera, namely: *Liphistius desultor* Schiödte, 1849, *L. malayanus cameroni* Haupt, 1983, *L. cf. thaleban* Schwendinger, 1990, *Heptathela kikuyai* Ono, 1998, *H. kimurai* (Kishida, 1920), *H. yanbaruensis* Haupt, 1983, *Ryuthela ishigakiensis* Haupt, 1983, *R. nishihirai* (Haupt, 1979) and *R. tanikawai* Ono, 1997 (**spec. reval.**). The geographical focus of this collection is Malaysia and Japan, and most of the material was collected by the Berlin-based zoologist Joachim Haupt.

**Keywords:** Araneae, Asia, Joachim Haupt, Liphistiidae, Mesothelae, ZMB

**Zusammenfassung: Gliederspinnen im Museum für Naturkunde Berlin.** Ein kommentierter Katalog der im Museum für Naturkunde Berlin deponierten seltenen Gliederspinnen (Araneae: Mesothelae: Liphistiidae) wird präsentiert. Das Museum beherbergt neun Arten (keine Typen) aus allen drei zurzeit anerkannten Gattungen: *Liphistius desultor* Schiödte, 1849, *L. malayanus cameroni* Haupt, 1983, *L. cf. thaleban* Schwendinger, 1990, *Heptathela kikuyai* Ono, 1998, *H. kimurai* (Kishida, 1920), *H. yanbaruensis* Haupt, 1983, *Ryuthela ishigakiensis* Haupt, 1983, *R. nishihirai* (Haupt, 1979), *R. tanikawai* Ono, 1997 (**spec. reval.**). Der geografische Schwerpunkt der Sammlung liegt in Malaysia und Japan, wobei der Großteil des Materials von dem Berliner Zoologen Joachim Haupt gesammelt wurde.

Mesothelae is a fairly small suborder of spiders (currently 87 species in three genera, Platnick 2014) which are nevertheless of considerable phylogenetic interest. On first appearance they resemble mygalomorph spiders (“tarantulas”, etc.), but in fact they are widely accepted as the most basal spider lineage retaining plesiomorphic characters such as a segmented opisthosoma bearing spinnerets near the middle of the underside. The latter character is the source of the name ‘meso’ – ‘thelae’. All other spiders have their spinnerets located at or close to the rear of the opisthosoma and are grouped in the suborder Opisthothelae. Fossil data indicate that mesotheles – or at least similar-looking spiders with a segmented opisthosoma and similar carapace and eye morphology – were found across Euramerica during the late Carboniferous. For a recent account of new fossils, which also drew on the material documented

here for comparative purposes, see Selden et al. (in press). Today the group is restricted to eastern Asia (see below).

Living mesotheles are medium to large-sized spiders which construct a burrow covered by one or two trap-doors. Up to ten silken ‘trip-wires’ radiate from the burrow entrance. The spider lurks inside the burrow and is alerted to prey touching the silk threads which effectively act as a sort of ‘proto-web’. A detailed account of mesothele anatomy and biology can be found in Haupt (2003).

The Museum für Naturkunde in Berlin (MfN) hosts a small, but significant collection of these quite rarely collected spiders. As the first of a planned series of papers documenting the spider collections of this museum – particularly groups not covered previously by the Berlin type catalogues by Manfred Moritz and Sophie-Charlotte Fischer (e.g. Moritz & Fischer 1990, Moritz 1992) – we present an annotated catalogue of the Mesothelae holdings.

Much of the mesothele material of the MfN was assembled by the Berlin-based zoologist Joachim Haupt (Fig. 1), formerly of the Free-University Berlin and later of the city’s Technical University, who died in April 2013. As well as studying arthropod groups such as myriapods, mites, hexathe- lid spiders and whip scorpions – with a particular

Jason A. DUNLOP, Corinna STEFFENSEN, Museum für Naturkunde, Leibniz Institute for Research on Evolution and Biodiversity at the Humboldt University Berlin, Invalidenstrasse 43, 10115 Berlin, Germany, e-mail: jason.dunlop@mfn-berlin.de, corinna\_steffensen@hotmail.de  
Hirotugu ONO, Department of Zoology, National Museum of Nature and Science, 4-1-1, Amakubo, Tsukuba-shi, Ibaraki-ken, 305-0005 Japan, e-mail: ono@kahaku.go.jp

Dedicated to the memory of Joachim Haupt who died in April 2013.

submitted 13.12.2013, accepted 29.4.2014, online 26.5.2014

focus on micro-morphology and ultrastructure – Joachim Haupt worked extensively on the biology and systematics of mesothele spiders (Haupt 1977, 1979, 1981, 1982, 1983, 1984, 1986, 1990, 1993, 2002, 2003, Haupt & Traue 1986, Haupt & Kooor 1993). He also had strong links to Japan, where he often collected as can be seen from the specimen labels and associated dates. We dedicate this present work to his memory. It should be noted that – contrary to published data – the types of his new species were not deposited in the MfN (formerly in East Berlin), having been described at the time when Berlin was still a divided city. Other spider specimens collected by Joachim Haupt can be found in the Zoological Museum of the University of Hamburg and in the zoological collections of the University of Rostock (both Germany), but the precise whereabouts of some type material remains equivocal. See below for notes on individual species.

#### Material and methods

All specimens listed here are stored in the wet collections (in 70 % alcohol) and have all been given ZMB (for Zoologisches Museum Berlin) repository numbers, which is the traditional acronym for the MfN. The data will be added to the database Systax. Some changes in nomenclature proved necessary to reflect the recognition of certain subspecies as distinct species in more recent publications. Individual case studies are discussed below and the specimen labels are amended accordingly. During the course of this work we also realised that a number of locality names were either incorrect or had at least been wrongly transcribed from the original labels. These have all been corrected here.

#### Results

Order *Araneae* Clerck, 1757

Suborder *Mesothelae* Pocock, 1892

Family *Liphistiidae* Thorell, 1869

Subfamily *Liphistiinae* Thorell, 1869

Remarks: According to authors such as Schwendinger & Ono (2011, and references therein), living mesotheles can be divided into two subfamilies: the South-East Asian *Liphistiinae* and the East Asian *Heptathelinae*. The latter subfamily was considered in some schemes – particularly Haupt (1983) – to be a distinct family, *Heptathelidae*, but see Raven (1985) for counterarguments.



**Fig. 1:** Joachim Haupt (died 2013), photographed in 2008. He collected much of the mesothele material held in the Museum für Naturkunde in Berlin (MfN) and worked extensively on these spiders. Image courtesy of the European Society of Arachnology (<http://www.european-arachnology.org/>).

*Liphistius* Schiödte, 1849

*Liphistius desultor* Schiödte, 1849 (Fig. 2a)

Material: ZMB 10074, 1♀; “Pulu Pinang” [Penang Island], Peninsular MALAYSIA; date uncertain, “Kauf Roesen 27.3.47” [purchased from Roesen]. ZMB 48315, “Falltür” [trapdoor]; Teluk Bahang, Penang Island, Peninsular MALAYSIA, leg. J. Haupt, 2.III.1981.

Remarks: This species – the first mesothele to be described (Schiödte 1849) – is restricted to Peninsular Malaysia. There is no further data about whom ZMB 10074 was purchased from. The locality is, in both cases, most likely Penang Island since the literal translation of the locality of the label is “areca palm island” (Schwendinger pers. comm.). This species was also reported from the nearby mainland (Platnick et al. 1997).

*Liphistius malayanus cameroni* Haupt, 1983

Material: ZMB 48532, 2 juv.; “Berinchang” [Brinchang or Berincang, Peninsular MALAYSIA]; leg. Haupt, 16.IV.1984.

Remarks: Also endemic to Peninsular Malaysia; as its name implies, this subspecies occurs in the Cameron Highlands. The holo- and paratypes of this species were explicitly noted as having been deposited in the Zoologisches Museum Hamburg (see Haupt 1983: 282), and as having been collected in 1981. Both specimens in Berlin are also from the type locality, but both are juveniles and since they postdate the original description, they cannot be part of the type series.

*Liphistius cf. thaleban* Schwendinger, 1990

Material: ZMB 48313, 1 f, m, juv.; Thaleban National Park (near Satun), southern THAILAND, leg. V. Šejna, X.1998; partly disarticulated, probably dried at one stage.

Remarks: The collector is Vladimír Šejna (Czech Republic), who has collected numerous arachnids in the that area of Thailand; see e.g. Kovařík (2004) for scorpions.

Subfamily **Heptathelinae** Kishida, 1923

Remarks: Kishida (1923) established this group as a

tribe (Heptatheleae) within the subfamily Liphistinae (cf. Bonnet 1957: 2158).

Genus *Heptathela* Kishida, 1923

Remarks: In his 1983 paper, Joachim Haupt regarded all *Heptathela* from Kyushu to Okinawa as part of a single species – a concept reflected in the original MfN labels – albeit recognising several subspecies: *H. kimurai kimurai* (Kishida, 1920) (type locality: Shiroyama, Kagoshima-shi), *H. kimurai bigoensis* Haupt, 1983 (Kumamoto, North Kyushu), *H. kimurai amamiensis* Haupt, 1983 (Amami-oshima Island) and *H. kimurai yanbaruensis* Haupt, 1983 (Okinawa Island). Subsequently, Ono (2009) regarded all of these (plus some new taxa) as distinct species and this view has been adopted in the World Spider Catalog of Platnick (2014). Applying this current species concept to the Berlin material we now have voucher material from three *Heptathela* species. Note that Tanikawa's attempts to explain the species diversity of Japanese *Heptathela* (see Tanikawa et al. 2006; pers. comm. of A. Tanikawa to H. Ono) have not found favour;



**Fig. 2:** Representative examples, plus their labels, from each of the three mesothele genera in the MfN collections. a. *Liphistius desulfor* Schiödte, 1849 (juvenile). b. *Heptathela kimurai* (Kishida, 1920). c. *Ryuthela nishihirai* (Haupt, 1979). The latter two originated from the Joachim Haupt collection.



partly because of the large number of heterogeneous populations with a scattered distribution, but still often adjacent to one another.

***Heptathela kikuyai* Ono, 1998**

Material: ZMB 48317, 1 exuvia; Oita, Kyushu, JAPAN; [leg. J. Haupt], VIII.2004. ZMB 48318, 48342, 48345–47, 5 specimens; Oita, Kyushu, JAPAN; leg. J. Haupt, 25.III.2004.

Remarks: Originally labelled as *H. kimurai*, the geographical origin of these specimens – from Oita in Kyushu, the most southerly of Japan's four main Islands – implies that they should probably be *H. kikuyai* (sensu Ono 1998) which is common there; although we concede that several *Heptathela* species are known from this island (P. Schwendinger pers. comm.). The locality details are nonetheless a little vague as there is both an Oita Prefecture and a more specific locality of Oita-shi (= Oita City) in Kyushu. We assume the specimens come from somewhere in the wider Oita area.

***Heptathela kimurai* (Kishida, 1920) (Fig. 2b)**

Material: ZMB 48319, 1 specimen; Shiroyama, Kagoshima, Kyushu, JAPAN; leg. J. Haupt, date uncertain. ZMB 48341, 1 specimen; Kirishima, Kyushu, JAPAN; leg. J. Haupt, 23.III.2004.

Remarks: Schwendinger & Ono (2011) noted that this species is known from several localities in southern Kyushu where the species is endemic. ZMB 48319 is topotypic; the type specimen also originated from Shiroyama. ZMB 48341 could be from the Kirishima Shrine at Kirishima-shi, from Kirishima-shi (= Kirishima City) itself or from Mt. Kirishima situated on the border of Kagoshima and Miyazaki Prefectures.

***Heptathela yanbaruensis* Haupt, 1983**

Material: ZMB 48316, 1♂; JAPAN, locality uncertain; leg. J. Haupt, I.2006. ZMB 48320, 1 specimen; Iii (as "Jii"), Kunigami-son, Okinawa Island, JAPAN; leg. J. Haupt, 15.IV.1979.

Remarks: These specimens were originally labelled *Heptathela kimurai yanbaruensis*, as per Haupt's (1983) original description. However, as noted above, Ono (2009) recognised *H. yanbaruensis* as a distinct species; see also Schwendinger & Ono (2011). The species is currently recorded as endemic to Okinawa in the Ryukyu Islands (cf. Platnick 2014) which form an island chain from Kyushu in the north towards

Taiwan in the south. On the basis of the current data the distributional range of *H. yanbaruensis* can be restricted to the northern part of Okinawa Island (the Yanbaru area), thus ZMB 48316 probably comes from this part of Okinawa too. The holo- and paratypes of this species were explicitly noted as having been deposited in the Zoologisches Museum Hamburg (cf. Haupt 1983: 284). The present material, collected in 2006, cannot thus be part of the type series.

***Ryuthela* Haupt, 1983**

Remarks: The genus *Ryuthela* is restricted to the Ryukyu Islands (e.g. Tanikawa 2013, fig. 1).

***Ryuthela ishigakiensis* Haupt, 1983**

Material: ZMB 48337, 1 specimen, Mt. Omotodake, Ishigakijima Island, Yaeyama Islands, Ryukyus, JAPAN.

Remarks: Originally labelled as *R. nishibirai* (Haupt, 1979), the locality details (Ishigakijima Island) indicate that it belongs to the endemic subspecies *R. nishibirai ishigakiensis* Haupt, 1983. This taxon was elevated to species level by Ono (1997). The holo- and paratypes of this species were explicitly noted as having been deposited in the Zoologisches Museum Hamburg (cf. Haupt 1983: 287–288). The specimen in the MfN also comes from the same locality as the types, however there is no explicit indication that the Berlin example belongs to the type series.

***Ryuthela nishibirai* (Haupt, 1979) (Fig. 2c)**

Material (all from Okinawa Prefecture, JAPAN): ZMB 24561, 2♂, 1♀; Sueyoshi [spelled Suyeyoshi on label], Shuri in Naha-shi, leg. J. Haupt, 18.IV.1980/XI.1981. ZMB 48312, 1 egg case, 1977/78. ZMB 48314, 1 egg case, 1977. ZMB 48326, 1 exuvium; Lake Ryutan, Shuri-mawashi-cho, Naha-shi, 28.III.1996. ZMB 48327, 1 exuvium; Chibana (area name of Okinawa-shi), 16.VI.1982. ZMB 48328, 1 exuvium; Lake Ryutan, Shuri-mawashi-cho, Naha-shi, 20.III.1996. ZMB 48329, 1 exuvium; Chibana, 15.IX.1997. ZMB 48330, 1 exuvium; Funaura Iriomote, 28.III.1996. ZMB 48331, 1 exuvium; Nago-dake, northern part of Okinawajima Island, 28.III.1996. ZMB 48332, 1 exuvium; Unten area, Nakijin-son, Kunigami-gun Okinawajima Island, 24.VII.1997. ZMB 48333, 1 exuvium; Lake Ryutan, Shuri-mawashi-cho, Naha-shi, 28.III.1996. ZMB 48334, 1 exuvium; Lake Ryutan, Shuri-mawashi-cho, Naha-shi, 24.VII.1997. ZMB 48335, 1 exuvium; Su-

eyoshi [spelled Suyeyoshi on label], Shuri in Naha-shi, 28.III.1996. ZMB 48336, 2 specimens, Sueyoshi [as Suyeyoshi (sic)], Shuri in Naha-shi, leg. Haupt, 27.VII.1993. ZMB 48338, 1 specimen; Sueyoshi [as Suyeyoshi (sic)], Shuri in Naha-shi, Okinawa, Japan, leg. Haupt, 27.VII.1993. ZMB 48339, 2 specimens; Sueyoshi [as Suyeyoshi (sic)], Shuri in Naha-shi, leg. Haupt, 27.VII.1993. ZMB 48533, 1 juv.; “Matoba”, leg. Haupt, 18.IV.1995. ZMB 48534, 1 juv.; [Lake] Ryutan, Shuri-mawashi-cho, Naha-shi, leg. Haupt, 22.IV.1995. ZMB 48535, 1 ♀ [abdomen only]; Chibana, leg. Haupt, VIII.1993.

Remarks: The syntype series is reported to have consisted of three males and females collected in March 1976 by M. Nishihira and J. Haupt in Shuri, Okinawa (see Haupt 1979: 372–373). Two pairs were deposited in the Free University Berlin. This is **not** associated with the Museum für Naturkunde which was formally part of the Humboldt-University in Berlin, whereby the FU Berlin unfortunately has no designated zoological museum and/or curator. A further type in the National Science Museum Tokyo under the repository numbers NSMT-Ar 422–423. Three additional pairs (improperly designated as paratypes by Haupt) were cited as being in the author’s personal collection. Some specimens listed above come from Lake Ryutan and Sueyoshi – which lies in the Shuri area – thus it is possible that they are part of the original material (the “paratypes”) examined by Haupt. However, since their collecting dates (1980–81, 1993) post-date the collecting (1976) and description (1979) of the type material, they cannot be the “paratypes” from the author’s private collection. At present the whereabouts of these specimens are unknown. They could not be traced during a recent survey of Haupt’s material deposited in Rostock, which seems to contain only a single (non-type) *Liphistius* specimen as a representative of the mesotheles (JAD pers. observ. in 2013). Note that ZMB 48330 is associated with a locality (Iriomotejima Island) which is notably south-west of Okinawa Island. This exuvia could come from a specimen belonging to the island endemic *Ryuthela tanikawai* (see below).

***Ryuthela tanikawai* Ono, 1997, spec. reval.**

Material: ZMB 48325, 1 exuvia; Funaura, Iriomotejima Island, JAPAN, 23.VIII.1991.

Remarks: Originally labelled as *R. nishibirai*, its locality data implies that it belongs to the subsequently recognised and endemic *R. tanikawai*. Recently Ta-

nikawa (2013a) noted that some species are based on female genital characters only which may be strongly variable within populations, and thus suggested that *R. tanikawai* is a junior synonym of *R. ishigakiensis* (see above). This nomenclatural act was also accepted in the latest version of the World Spider Catalog (Platnick 2014). However, we suggest here that this synonymy is inappropriate. Our critique would be that Tanikawa (2013a) sank taxa based initially on morphological data alone, and then in a paper directly following on from the first (Tanikawa 2013b) offered additional DNA data albeit based on this new nomenclature only. In our opinion it would have been better to conduct a genetic analysis of all the available populations first, and then discuss the taxonomic implications afterwards. Both morphological differences in the male palp (Ono 2009) and molecular data (Tanikawa 2013b) may support the hypothesis of past isolation of a *Ryuthela* population on Iriomotejima Island. Further study of this species (or subspecies?) recognition problem by one of us (HO) is currently in preparation and we refer to this forthcoming work for details.

**Acknowledgments**

We thank Anja Friederichs (Berlin) and Andreas Bick and Katharina Hucksdorf (Rostock) for curatorial assistance, and Silvian Patzschke for help with photography. Peter Schwendinger (Geneva) and an anonymous reviewer offered valuable improvements to the typescript.

**References**

- Bonnet P 1957 Bibliographia Araneorum. Tome II (3me partie: G – M). Douladoure, Toulouse. pp. 1927–3026
- Clerck C 1757 Svenska spindlar, uti sina hufvud-slägter indelte samt under några och sextio särskildte arter beskrefne och med illuminerade figurer uplyste. Salvius, Stockholmiae. 154 pp., Pl. 1–6
- Haupt J 1977 Preliminary report on the mating behaviour of the primitive spider *Heptathela kimurai* (Kishida) (Araneae, Liphistomorphae). – Zeitschrift für Naturforschung 32: 312–314
- Haupt J 1979 Lebensweise und Sexualverhalten der mesothelen Spinne *Heptathela nishibirai* n. sp. (Araneae, Liphistiidae). – Zoologischer Anzeiger 202: 348–374
- Haupt J 1981 Stridulation als Kommunikationsmittel bei einer mesothelen Webspinne (Araneae: Liphistiidae). – Verhandlungen der Deutschen Zoologischen Gesellschaft 1981: 232
- Haupt J 1982 *Heptathela nishibari* (Liphistiidae) – Werbung und Begattung. Film E 2669 des IWF, Göttingen 1981. – Publikationen zu wissenschaftlichen Filmen, Sektion Biologie (15)9: 1–5



- Haupt J 1983 Vergleichende Morphologie der Genitalorgane und Phylogenie der liphistiomorphen Webspinnen (Araneae: Mesothelae). I. Revision der bisher bekannten Arten. – *Zeitschrift für Zoologische Systematik und Evolutionsforschung* 21: 275–293 – doi: 10.1111/j.1439-0469.1983.tb00296.x
- Haupt J 1984 Comportement sexuel, morphologie génitale et phylogénèse des araignées Liphistiomorphes. – *Revue Arachnologique* 5: 161–168
- Haupt J 1986 Postembryonal development and trichobothriotaxie in Heptathelidae: possibilities and limits of a phylogenetic analysis. – *Actas X Congreso Internacional de Arachnologia, Jaca/España* 1986 1: 349–354
- Haupt J 1990 Comparative morphology and phylogeny of liphistomorph spiders (Araneida : Mesothelae). III. Provisional diagram of relationships in Heptathelidae. – *Bulletin de la Société européenne d'Arachnologie, hors serie* 1: 134–140
- Haupt J 1993 Lebensdauer von mesothelen Spinnen. – *Bulletin de la Société Neuchâteloise des Sciences Naturelles* 116: 113–116
- Haupt J 2002 Fungal and rickettsial infections of some East Asian trapdoor spiders. In: Toft S & Scharff N (eds.) *European Arachnology 2000*. Aarhus University Press, Aarhus. pp. 45–49
- Haupt J 2003 The Mesothelae – a monograph of an exceptional group of spiders (Araneae: Mesothelae). – *Zoologica* 154: 1–102
- Haupt J & Kovoov J 1993 Silk-gland system and silk production in Mesothelae (Araneae). – *Annales des Sciences Naturelles, Zoologie* (13)14: 35–48
- Haupt J & Traue D 1986 Vergleichende Analyse von Vibrationssignalen der Männchen von drei Gliederspinnenarten (Araneae: Mesothelae). – *Verhandlungen der Deutschen Zoologischen Gesellschaft* 79: 212–213
- Kishida K 1920 Discovery of a primitive spider in Japan [no English title; Japanese title translated by H. Ono]. – *Zoological Magazine (Tokyo)* 32: 362
- Kishida K 1923 *Heptathela*, a new genus of liphistiid spiders. – *Annotationes zoologicae Japonenses* 10: 235–242
- Kovařík F 2004 A review of the genus *Heterometrus* Ehrenberg, 1828, with descriptions of seven new species (Scorpionidae, Scorpionidae). – *Euscorpius* 15: 1–60
- Moritz M 1992 Die Typen der Arachniden-Sammlung des Zoologischen Museums Berlin. X. Araneae: Lycosidae. – *Mitteilungen aus dem Museum für Naturkunde in Berlin* 68: 309–329 – doi: 10.1002/mmzn.19920680213
- Moritz M & Fischer S-C 1990 Die Typen der Arachniden-Sammlung des Zoologischen Museums Berlin. IX. Araneae: Linyphiidae, Theridiidae. – *Mitteilungen aus dem Museum für Naturkunde in Berlin* 66: 293–307 – doi: 10.1002/mmzn.19900660203
- Ono H 1997 New species of the genera *Ryuthela* and *Tmarus* (Araneae, Liphistiidae and Thomisidae) from the Ryukyu Islands, Southwest Japan. – *Bulletin of the National Science Museum Series A (Zoology)* 23: 149–163
- Ono H 1998 Spiders of the genus *Heptathela* (Araneae, Liphistiidae) from Kyushu, Japan. – *Memoirs of the National Science Museum, Tokyo* 30: 13–27
- Ono H 2009 The spiders of Japan with keys to the families and genera and illustrations of the species. Tokai Univ. Press, Kanagawa. xvi+739 pp.
- Platnick NI 2014 The world spider catalog, version 14.5. American Museum of Natural History, New York. – Internet: <http://research.amnh.org/iz/spiders/catalog> (Feb. 10, 2014)
- Platnick NI, Schwendinger PJ & Steiner H 1997 Three new species of the spider genus *Liphistius* (Araneae, Mesothelae) from Malaysia. – *American Museum Novitates* 3209: 1–13
- Pocock RI 1892 *Liphistius* and its bearing upon the classification of spiders. – *Annals and Magazine of Natural History* (6)10: 306–314 – doi: 10.1080/00222939208677416
- Raven RJ 1985 The spider infraorder Mygalomorphae (Araneae): cladistics and systematics. – *Bulletin of the American Museum of Natural History* 182: 1–180
- Schiödt JC 1849 Om en afvigende Slægt af Spindlernes Orden. – *Naturhistorisk Tidsskrift* 2: 617–624
- Schwendinger PJ 1990 On the spider genus *Liphistius* (Araneae: Mesothelae) in Thailand and Burma. – *Zoologica Scripta* 19: 331–351 – doi: 10.1111/j.1463-6409.1990.tb00262.x
- Schwendinger PJ & Ono H 2011 On two *Heptathela* species from southern Vietnam, with a discussion of copulatory organs and systematics of the Liphistiidae (Araneae: Mesothelae). – *Revue suisse de Zoologie* 118: 599–637
- Selden PA, Shcherbakov DE, Dunlop JA & Eskov KY in press Arachnids from the Carboniferous of Russia and Ukraine and the Permian of Kazakhstan. – *Paläontologische Zeitschrift* – doi: 10.1007/s12542-013-0198-9
- Tanikawa A, Yoshio M & Tatsuta H 2006 A phylogenetic analysis of Japanese heptathelids based on mt-DNA [no English title; Japanese title translated by H. Ono]. In: Abstracts of the oral presentations at the 38<sup>th</sup> Annual Meeting of the Arachnological Society of Japan. – *Acta arachnologica* 55: 128
- Tanikawa A 2013a Taxonomic revision of the spider genus *Ryuthela* (Araneae: Liphistiidae). – *Acta arachnologica* 62: 33–40 – doi: 10.2476/asjaa.62.33
- Tanikawa A 2013b Phylogeny and genetic variation in the spiders of the genus *Ryuthela* (Araneae: Liphistiidae). – *Acta arachnologica* 62: 41–49 – doi: 10.2476/asjaa.62.41